

A Strategy with the goal of reducing risks of waterborne illness in rural communities: political ecology, environmental science and engineering

**Graciela I. Ramirez Toro, PhD
2014 PR Caribbean Science Consortium/Non-PRASA Systems
Workshop**





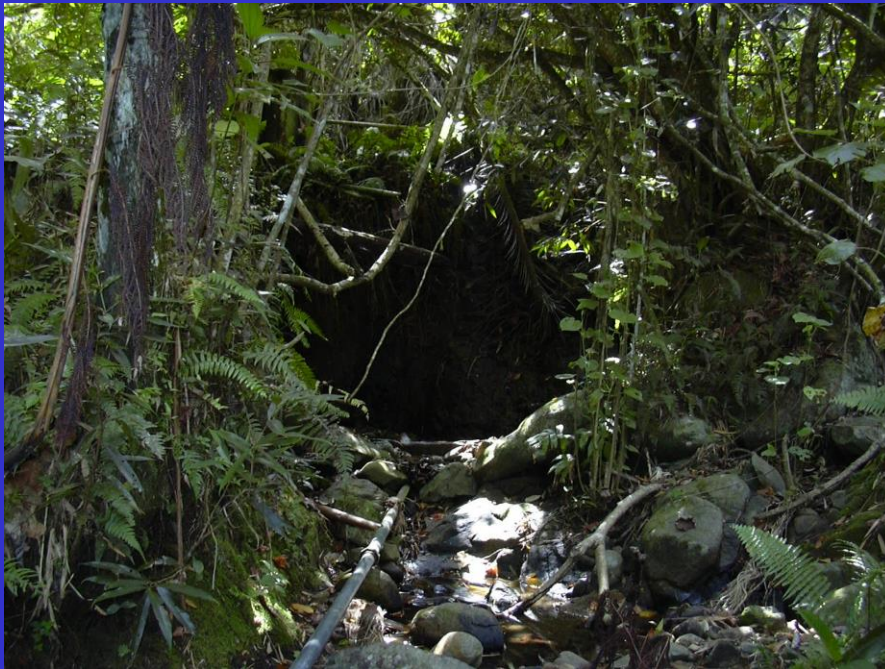
Thinking out of the box: appropriate technology and the multidisciplinary approach for solving persistent problems with small potable water supplies

The Institute of Medicine's Roundtable on Environmental Health
Sciences, Research, and Medicine, INSTITUTE OF MEDICINE OF
THE NATIONAL ACADEMIES (2008)

Roundtable on Environmental Health Science, Research and Medicine -
Workshop on Sustainable Water.

2004.11.11

SAFE DRINKING WATER FOR SMALL SYSTEM USERS: one size does not fit all



- **Demographics**
 - Different ethnicities
 - Different levels of education
 - Different economic levels
- **Administrative (different levels of governance) Operation and Administration may be:**
 - Voluntary
 - Contractors
 - Employees
- **Infrastructure**
 - Many old (>50 years)
 - Constructed with public money
 - Constructed privately
 - Different kinds of ownership
- **Watershed**
 - Different watershed or share watersheds
 - Different in water quality and quantity

Special Ownerships

Tribal, Possessions and Territories

- **550 sovereign nations and recognized tribes**
 - 982 systems
 - 900,000 persons served
- Most tribal nations seek federal funding for drinking water infrastructure but struggle to meet the requirements for O&M
- **TCR Regulations affect all drinking water systems in Puerto Rico, Virgin Islands, etc., 7 territories in all**
 - 1,012 systems
 - 6.6 million persons
- Most systems in these territories seek federal funding for drinking water infrastructure but struggle to meet the requirements for O&M

Small and very small potable water systems: challenges and sustainability

- Among the poorest and most remote
- Limited access to infrastructure
- Almost complete isolation from Federal and State government decisions concerning their resources
- Very little investment in the communities by Federal and State Governments



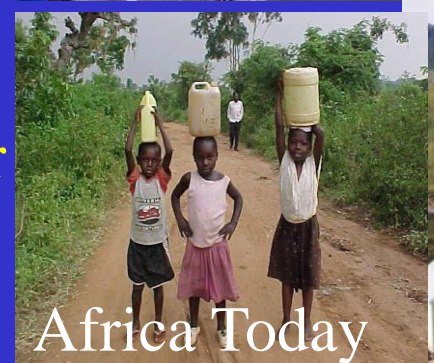
The struggle to make water and health for rural America a priority

- ✓ In the United States, **92%** of small community water systems, serving 3,300 or fewer individuals were not in compliance with SDWA standards in 2004 (EPA 2004).



The struggle to make water and health for rural America a priority

- ✓ Are the reasons why people lack safe drinking water in developed countries different from those in developing regions?
- ✓ The factors seen in developing countries may or may not be contributing to the drinking water situations in small community systems that have been found to be in violation of the SDWA.



Can we guarantee safe drinking water with just regulations?

✓ In many countries regulations are goals.



- In small systems in the US regulations could become goals or the community
- Water is a secondary activity
- Government have to understand how to make safe water a goal for these rural communities

The struggle to make water and health for rural America a priority; **research**

- ✓ Significant resources and research are dedicated to addressing the complex conditions in developing countries.
- ✓ There is a disproportionate lack of research and public attention on the fact that there are still numerous small communities in developed countries that do not consistently have safe drinking water.

Rhode Island 2007



PR Today



MA Today



PR 2007





- ✓ The United Nations (UN) Water Program (2006) estimated that 1.1 billion people around the world lack safe drinking water.
 - There are a myriad of factors acting in concert that perpetuate inequality in access and use of drinking water.

CONVERSATIONS WITH VOLUNTEERS AND ADMINISTRATORS OF SPWS ; PRE PILOT SOCIAL ANTHROPOLOGY INTERVIEWS - GRACIELA RAMIREZ-TORO & EVA VILLALON (2003)

POLITICAL ECOLOGY OF SAFE DRINKING WATER IN THE UNITED STATES WITH A CASE STUDY FOCUS IN PUERTO RICO – SARAH OPITZ-STAPLETON & GRACIELA RAMIREZ-TORO (2009)

Water Quality Analyses, Operation and Asset Management in Small Systems; Tools to Improve Public Health

H. Minnigh, G. I. Ramírez toro,

- ✓ Demonstration project:
 - Development of a model to use in capacity development to improve water, sanitation and health in a sustainable social and economic context
 - Assessment of the performance of federal and local government in understanding low income community and the collaborative problem solving model
 - As well as others.

What to do? Pre pilot for:

A community educational intervention to Improve Public Health

- Is the perception that residents and owners of small systems in PR are not interested or cannot be interested in the development of capacity among their members to improve their water system operation and management true?
- Can the health of users in small, non-PRASA potable water system be improved, provided the capacity of operators and administrators is improved?
- Can the quality of the water served be improved by better management of assets?

The issues

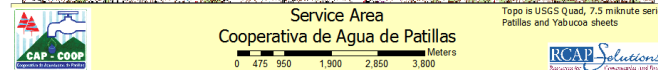
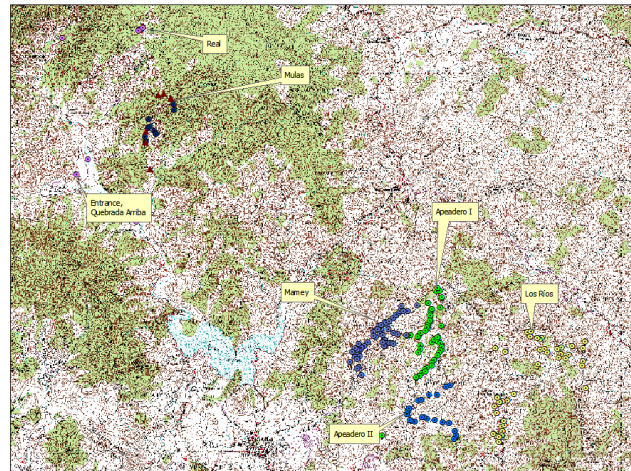
- How much illness is due to the consumption of contaminated drinking water in rural communities with their own drinking water systems?
- Can this burden of illness be reduced by low cost interventions to promote asset management?
- How can we answer these questions?



Puerto Rico



Patillas



SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCESSION STORY*

✓ Building the collaboration: the PR IWG

- **Caribbean Environmental Protection Division (Caribbean Field Office of US EPA)**
- **The Drinking Water Academy, Headquarters US EPA**
- **USDA Rural Development – Local Office**
- ***Corporación de Desarrollo Rural de Puerto Rico***
- **Extension Services Department of Agriculture - Patillas**
- ***RCAP Solutions, Inc***
- **CECIA – UIPR**
- **US EPA NATIONAL LAB**
- **Gabriella and Paul Rosenbaum Foundation**
- **10 communities with Small Potable Water Systems**
 - **CAP - Patillas COOP for Small Potable Water Systems**
- **Municipality of Caguas /Pfizer**
 - **AsocAguas**
- **MERCK, CHEROX, Sergio Suares, Pedro Lorenzo, entre muchos otros**

SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCESSION STORY*



Building the collaboration:
the CAP

- Extension Services
(Department of Agriculture)
- Administración de Fomento Cooperativo*
- Coporaación de Desarrollo Rural*
- RCAP Solutions, Inc

SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCESSION STORY*

Building the collaboration:
the CAP



- Each community elected a board
- The board members became *super delegates* to general assembly
- The motion of forming a COOP with representation from each community was approved
- The CAP was formed and a board was elected.*
- By- laws were prepared*
- The CAP was Incorporated in the Department of State as CAP-COOP*

Water Safety Framework

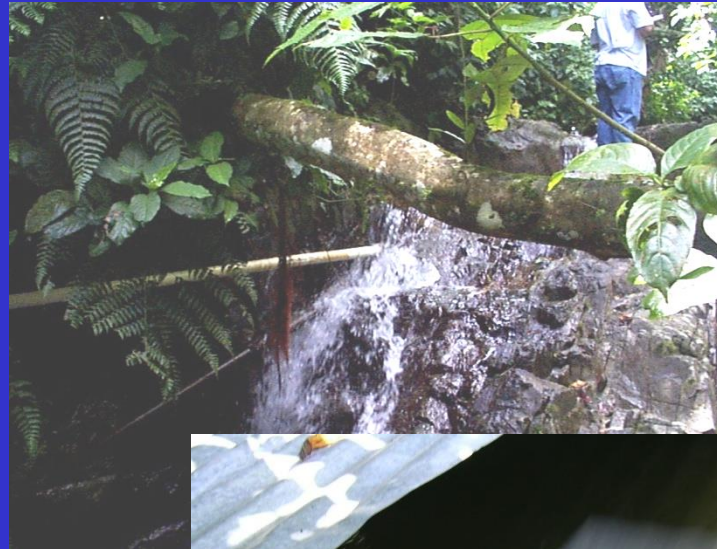
- Health based targets
- Water Safety plans
 - System assessment
 - Operational monitoring
 - Management plans
- Independent surveillance



From Paul Hunter, University of East Anglia, *Water policy in rural settings*

Concurrent studies and capacity development

- **Water Safety Plan**
- Training and Capacity (formal and informal)
- WQ Testing Pathogen occurrence (Risk)
- Epidemiology



SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCESSION STORY*

Working under the collaborative model: the CAP and the agencies



- System component inventory
- Community meetings to report on findings
- Action Plan to correct deficiencies
- PR IWG for Small Systems collaborates with the CAP-COOP
- ☺ grant money for construction
- ☺ technical and educational assistance



San German
(Southwest PR)

SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCES STORY*

- Informal Training
 - Meetings, surveys, demonstration to general community members; summer camps activities for the children





Concurrent strategies

Formal Capacity Development

- *Operator Training*
- *Administrator Training*



SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCESS STORY*

- **Formal Training**

- Potable Water Operator Technician
- Small potable water Administrator Technician

Community involvement and empowerment-

- **Two candidates per community**
 - Residents of the communities
 - Only High School Graduates
 - Available to study for a year
 - Available to dedicate 12 hours
 - » per week to the communities



SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : *A SUCCESS STORY*

The development of new leaders:

- community participants initially joint for the economical opportunity
- soon they understood the importance of their roll in improving community health
- they gain confidence as they develop skills
- they improve their lives by gaining a “carrer”



SAFE DRINKING WATER FOR REMOTE LOW-INCOME COMMUNITIES IN PUERTO RICO : A *SUCCESS* STORY

- The *practicums*:

- Interaction with community members
- Understanding the importance of the environment in the communities
- Opportunity to develop social work at the same time of making a living
- Develop experience with community issues
- Understanding of the relationship between system operation, administration and Public Health



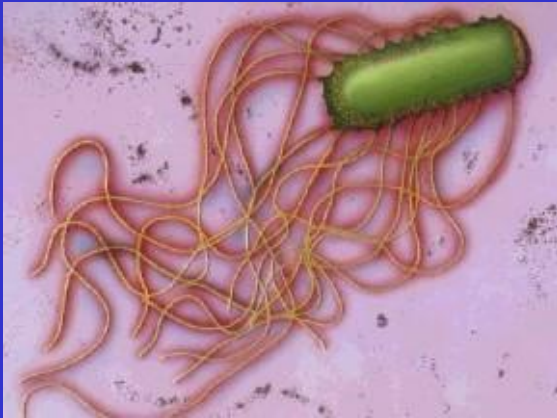


Concurrent strategies

- Training and Capacity
 - Operators
 - Administrators
- *Water Safety Plan*
- *Pathogen occurrence (Risk)*
- *Epidemiology*



**Water Quality Analyses, Operation and Asset Management in Small Systems;
Tools to Improve Public Health :** H. Minnigh, G. I. Ramírez toro, Diane Herson, Kathleen Verville



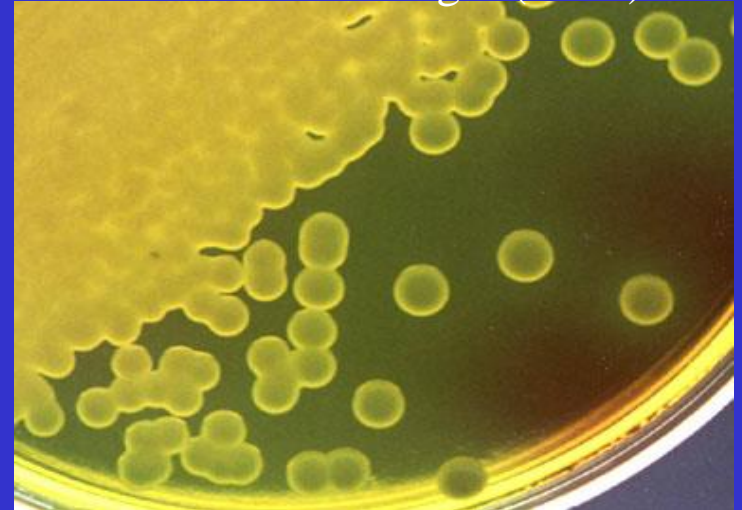
Salmonella

- [http://www.nasa.gov/vision/earth/livingthings/01dec_yeast.h](http://www.nasa.gov/vision/earth/livingthings/01dec_yeast.html)

Typical Salmonella colonies on Bismuth Sulfite Agar (BSA)



Brilliant Green Agar (BGA)



- <http://www.jlindquist.net/generalmicro/dfentericplate2.html>

- http://www.emdchemicals.com/analytics/Micro_Manual/TEDISdata/prods/1_05418_0500_5000.html

The pilot

- Three types of questionnaires

Health in Communities with Small Potable Water Systems (first visit)

- 6 questions for demographics
- 8 questions on general health
- 4 about perceptions and knowledge about potable water

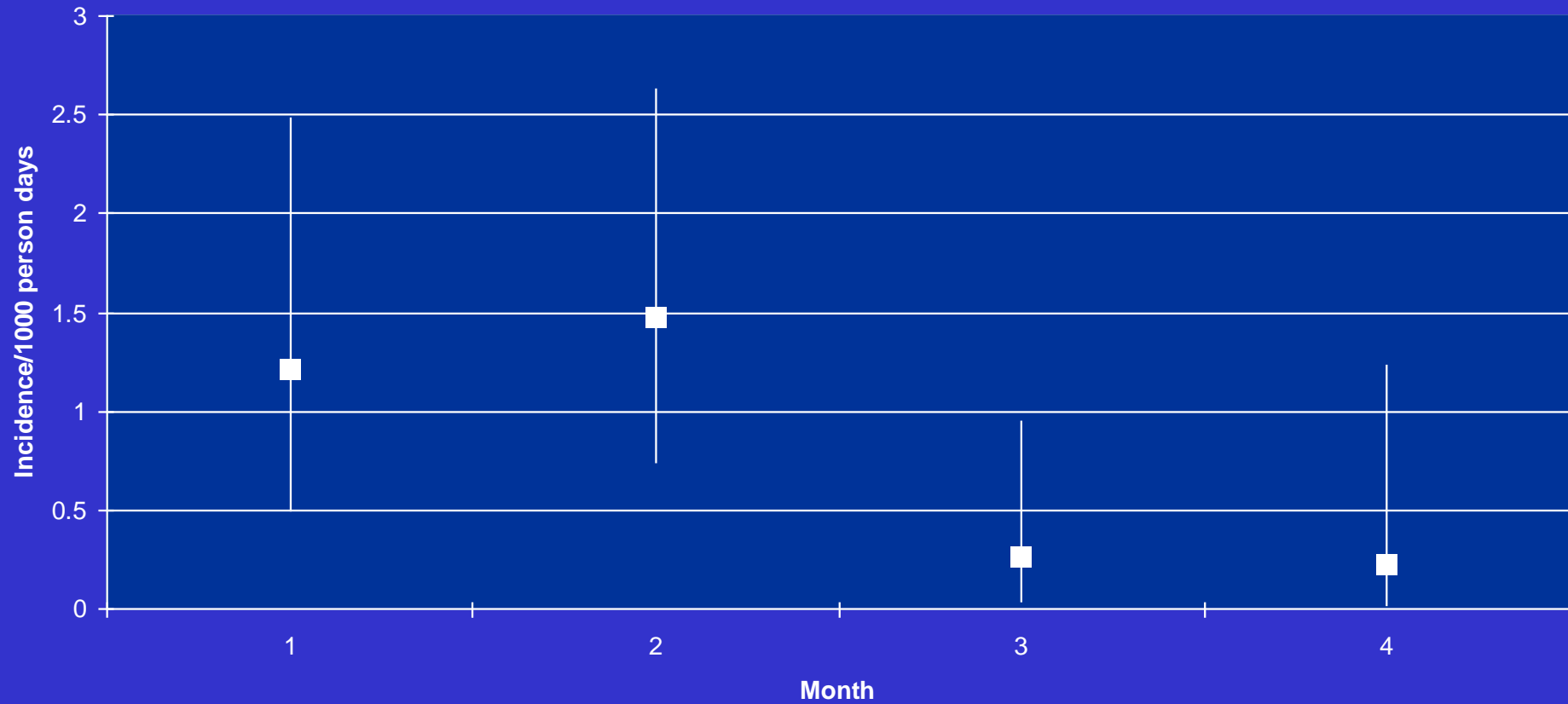
Health Follow-up (once per month for 4 month)

- 7 questions about gi illness

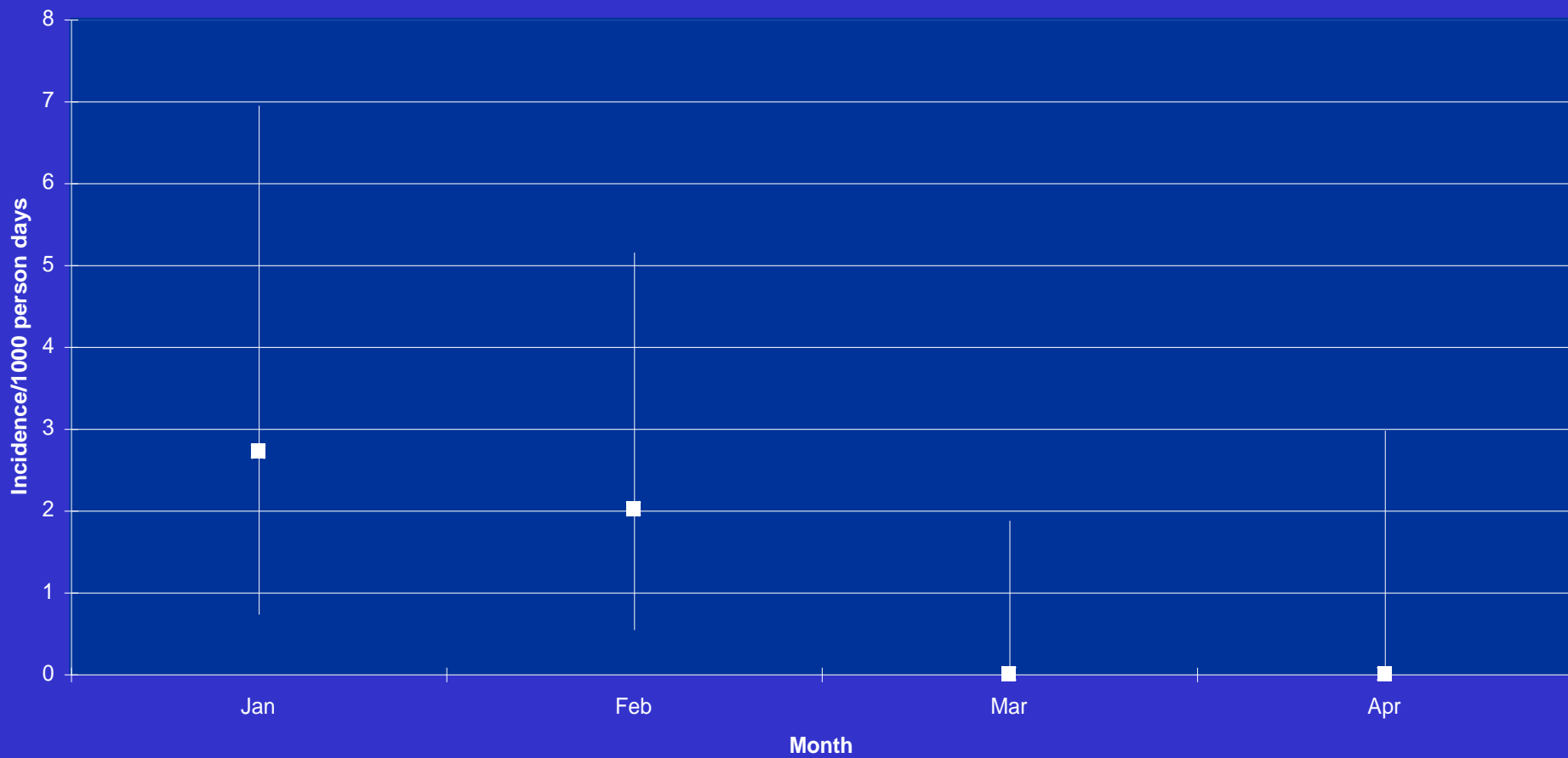
GI Illness Report

- 19 questions about symptoms if a case was identified - for all that reported being ill during the previous month

Incidence for adults and children



Incidence for children



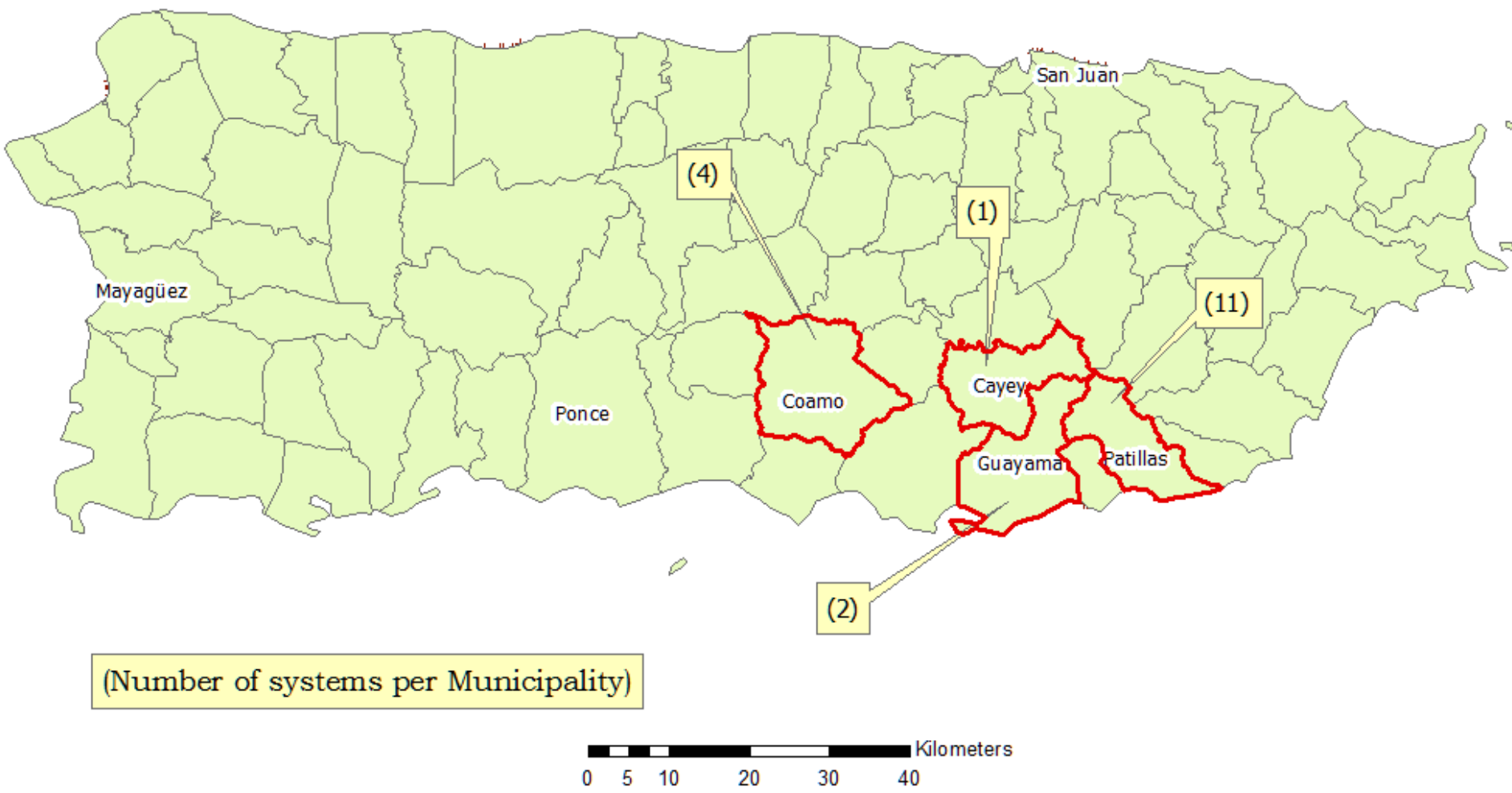
Health Studies

- **Student Operator Involvement in Systems Reduced Incidence of Diarrheal Disease**

- Reduction in diarrhea was significant after intervention; stronger in children and elders

(Fishers exact test
 $p=0.002$ for all and for
children ($p=0.0081$))





Case control study

(data not published: Paul Hunter, Graciela Ramirez & Harvey Minnigh)

- 43% of illness in non-intervention communities is due to contaminated drinking water as compared with those in the intervention
- Communities can be engaged to participate in strategies to improve health and make their water supply sustainable but education needs to be pertinent and take into consideration community goals

Water Quality Analyses, Operation and Asset Management in Small Systems; Tools to Improve Public Health

H. Minnigh, G. I. Ramírez toro,

- Demonstration project outcomes:
 - More than \$500,000 leveraged as in-kind contributions.
 - Two community associations built:
 - Cooperativa de Acueductos de Patillas (8 communities – approximately 7,000 people affected
 - AsocAguas (17 communities – approximately 15,000 affected
 - 28 community members acquired college education; displaced and unemployed community members now all employed in high-paid, technical jobs.
 - Two short career educational programs developed

Water Quality Analyses, Operation and Asset Management in Small Systems; Tools to Improve Public Health

H. Minnigh, G. I. Ramírez toro,

- Demonstration project outcomes [continued]
 - 9 members of the communities certified as Water Treatment Plant Operators at the highest level
 - First two women operators on the Island; first woman administrator and operator
 - First known scientific study in small systems in that links educational intervention with system improvement, water quality improvement and improvement in community health
 - Characterization of causes of illness in 17 communities

The struggle to make water and health for rural America a priority

- ✓ Water supply problems are rarely caused only by technological inability to supply water.
 - expectations are challenging the ability of traditional management approaches in meeting actual need and situational reality.
 - Administrative orders for small system in PR and the problem of cost of energy



The struggle to make water and health for rural America a priority

Power is enacted by decision making:

- ✓ Knowledge is a product of social relationships in constant change
- ✓ Power knowledge relationships are dictated by spatial, temporal and social scales of the different actors.



The struggle to make water and health for rural America a priority; research

Facts

- ✓ Most people, including scientists, have never seen their own water supply system
- There is little knowledge in the population and academia about the research needs in small rural communities and small systems.



The struggle to make water and health for rural America a priority; the need to rethink our *perceptions*

- Small colleges that serve rural America may not have the capacity to design or carry out high quality research.
- OR...a small percentage of universities have the capacity to perform full scale research.
- Communities should not participate in the design of research.
- Compliance research cannot be done in small systems because the sample is too small
- The value of performing similar studies in several sizes of systems with several classes of treatment is underestimated



Facts

- ✓ Most curricula is not multidisciplinary enough to teach science in the social contexts that apply
- ✓ Most curricula target advanced and complicated technology developments that are neither applicable or feasible for rural America

The struggle to make water and health for rural America a priority

- ✓ power relationships such as:
 - “First/Third Worlds,
 - rich/poor
 - or rulers/ruled



The struggle to make water and health for rural America a priority

- ✓ Traditional approaches to water resource management have involved linear, top-down models in which the state regulates and dictates operation standards.
- ✓ Water users are given little say in the operations and their preferences or capabilities in contributing to management of the water supply are often not considered.
 - ✓ **Top to bottom approach:**
 - ✓ Regulatory review process
 - ✓ Data and information
 - ✓ Political system
 - ✓ Interaction between programs



The struggle to make water and health for rural America a priority: what struggle ?

➤ We still need to do a lot of work;

- ✓ to recognize that we have a problem.
- ✓ to understand the social and economic context of the problem
- ✓ to educate the public: regulators, community users and administrators, legislatures, teachers and others

➤ But the answer can not come just top to bottom...



The authors gratefully acknowledge the support of the Gabriella and Paul Rosenbaum Fdn. of Chicago that made this work possible.